

Clean Technology Initiative (CTI)

Final Report

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With:

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1. Introduction

USAID/India established its Clean Technology Initiative (CTI) in 1997 as the second five-year phase of its Trade in Environmental Services and Technology (TEST) project, extending to 2002. CTI sought to further the mission's Strategic Objective of "increased environmental protection in energy, industry and cities," and the intermediate result of "pollution per unit of output reduced in companies in key industrial sectors."

1.1 CTI concept

Building on its experience with industrial environmental improvement under TEST, the mission designed the new CTI to focus on voluntary application of clean technology. CTI sought to incorporate the concepts of US-Indian partnerships and technology transfer through trade that had been established under TEST and throughout Asia by the US-Asia Environmental Partnership. More particularly, CTI sought to achieve mission objectives through applications of ISO 14000 certification, industrial extension services, Greening the Supply Chain, benchmarking, and environmental reporting tools for India that industries were developing globally. In addition, CTI planned a program to support investments in clean technology through a program with ICICI. As a result, CTI envisaged limited, albeit important, engagement with Indian government environmental agencies; instead of focusing on regulatory and other market-based policy incentives, the mission designed CTI to foster environmental improvements through voluntary actions grounded on business self-interest. Hence establishing the "business case" for CTI was of paramount importance. The business case is that investments in environmental technologies and environmental management systems pays business dividends and improves the "bottom line."

1.2 Task Order Award

USAID/India awarded International Resources Group, Ltd.(IRG), a Task Order in June 1997 to implement CTI under IRG's Environmental Policy and Institutional Strengthening Indefinite Quantity Contract (EPIQ) with USAID's Global Bureau. The work period extended from June 1, 1997 through September 30, 1999.

1.3 Project Modification

Political events nearly derailed CTI less than a year after it began, and not more than 6 months after operation at full strength. Following India's test of a nuclear device on May 13, 1998, USAID "froze" CTI for approximately six weeks as it determined the effect of mandatory US (Glenn Amendment) legislative sanctions. While IRG's staff remained in place in Delhi, CTI activities wound down with no new ones begun. IRG staff in New Delhi and Washington, D.C., worked with USAID to redesign the program and reorient the existing activities to focus on Industrial Greenhouse Gas Emissions and Global Climate Change, as this topic, like humanitarian assistance, was exempted from the sanction provisions. CTI with a GHG/GCC

focus therefore became the modified third phase of TEST. IRG received approval of the Task Order modification on July 2, 1998.

As a result, and as explained below, under the revised CTI some new activities ones were added, a few others ceased, but the central elements of CTI continued and formed the model for the ensuing three-year phase to be carried on through September 30, 2002. The major shift was that CTI stopped its efforts to link voluntary initiatives with government environmental policy. This was being done through analysis of corporate environmental reporting experiences in India, and the problems and opportunities posed by government requirements (ignored by most companies) for corporate environmental statement requirements.ⁱ CTI reoriented its future activities under a revised Scope of Work that established a dominant emphasis on GHG emission reduction. The transition was logical; industry response to concerns about GHG/GCC as well as to concerns about local pollutants required application of clean technology and environmental management systems. CTI therefore continued to promote a variety of private voluntary environmental initiatives to identify, manage, and reduce sources of GHG emissions, recognizing that these clean technology and management approaches remained important for reduction of local pollutants as well. Again, CTI's success depended on its establishing a strong business case for its approach that would be attractive to Indian industry.

This final report to USAID on IRG's CTI project implementation from June 1997 through September 1999 is presented as follows:

- Industrial voluntary environmental performance before and after CTI,
- Summaries of key CTI project activities,
- Lessons learned and recommendations for key activities.

2. Background

2.1 The Environmental and Economic Situation at CTI's Beginning

CTI began its work during a time of rising public concern in India about environmental pollution and the continued weakness of government environmental regulations and enforcement. Decisions of the Indian Supreme Court and several State High Courts had closed a large number of Indian industries, at least for a short time, in response to constitutional rights arguments. While the resulting injunctions caught industry's attention, enforcement capabilities of State Pollution Control Boards were notoriously weak. Central level actions to spur industrial pollution control through establishment of environmental standards and new requirements for annual environmental statements from industry were similarly ineffective. At the same time, Indian industry was aware of increasing concerns about their environmental practices from international buyers, and they recognized growing market pressures for improved industrial environmental performance. A profile of Indian environmental regulations and industrial and NGO engagement in clean technology initiatives and practices can be found in the US-AEP country profiles.ⁱⁱ

Until CTI, however, neither the Indian government nor donor agencies had made concerted efforts to help Indian industry improve environmental performance through use of the emerging voluntary tools, such as the environmental management systems of ISO 14000, greening the supply chain, or efficient benchmarking techniques allowing companies to measure their environmental and energy efficiency progress and compare performance results to others. Industrial extension services designed to provide industry with access to clean technology information were also weak, and there were few opportunities for industry to obtain concessional financing for application of clean technology.

2.2 The Challenge to CTI

The size of India's industrial system reveals the magnitude of the task that CTI faced. With industrial output in India valued at about \$100 billion, produced by over 100,000 industrial enterprises, CTI expenditures were destined to be only a drop in the bucket. On one hand CTI needed to wrestle with decades of serious environmental neglect and bad habits, fostered in part by government controls and subsidies that encouraged resource and energy waste and inhibited competitive responses to markets. On the other hand, CTI lacked the information and market-based advantages available to technology transfer programs in East Asia. For example, Indian business was constrained by limited Internet access, and its traditional focus on domestic markets, exporting only 20 percent of what China did, and receiving about 15 percent of China's foreign direct investment. Many of these conditions have remained to challenge CTI. Despite liberalization in 1991, the World Economic Forum recently ranked India 52nd out of 59 countries in its Global Competitiveness Report – worse than in 1997 – based on its openness to trade and investment, role of the state, finance, infrastructure, technology, management, labor and institutions. In short, while the condition of India's economy and economic policies led logically

toward the development of CTI's voluntary approach, these same voluntary tools faced greater limitations in India than they faced in South East Asia.

2.3 Strategy for Responding to this Challenge

Despite these barriers, the CTI project and the Indian business have had the security of knowing that liberalization of trade and investment has become widely accepted among major Indian parties. This emerging policy consensus has allowed CTI to build on the favorable trends in market forces that increasingly favor voluntary actions by industries to adopt cleaner operations and more environmentally friendly products. Moreover, because the US is India's largest trading partner for both imports and exports, CTI can provide welcome links and information exchanges between US and Indian firms.

From the outset, IRG and USAID perceived that CTI's success depended on how well it could demonstrate to Indian businesses that environmental performance has become a competitive factor globally, and that their profitability will depend increasingly on how well they integrate sound environmental management into their business practices. CTI has therefore needed to develop and demonstrate successful models of state-of-the-art environmental management practices and clean technologies in priority sectors. This effort has required participation of industrial enterprises selected for their capabilities and their potential impact. CTI must then disseminate the information gained widely throughout India.

2.4 The Tools Employed

Over the course of two years and despite the GHG/GCC modification in 1998, CTI's *ISO 14000 program* has been the centerpiece of activity. Buttressing that have been CTI actions to strengthen *industrial extension services*—the industrial environmental performance information delivery systems available to Indian industry. Both these activities have been modified under the GHG/GCC focus. *Project financing* activities have been carried out over the past two years through the ICICI program of USAID, although the program has had significant shifts in emphasis and funding availability during that time, especially after the imposition of U.S. sanctions. IRG introduced its approach to *benchmarking* in 1997 and sharply increased benchmarking after the GHG program shift. Activities focused on ways in which benchmarking techniques could identify business opportunities for reducing energy and other production costs as well as reducing GHG and other pollution emissions. *Greening the supply chain* activities were expanded in 1999, and these are now poised for increased implementation under the next CTI phase. Lastly, CTI provided new GHG reduction opportunities by elaborating *the GCC modeling tool of MARKAL*, which is available for Indian policy makers to assess macro and sector-level options for reducing GHG emissions.

Section 3 below describes the activities that IRG/CTI carried out to develop and disseminate these tools. A list of events – workshops, conferences, lectures, and so forth – that we undertook over the past two years is found in Appendix A.

3. CTI Accomplishments: The Situation Today

By the end of CTI's two years there have been substantial changes directly created by CTI. (See box below):

- a systematic system for environmental benchmarking for industry application
- one prototype GSCM system initiated, when none existed previously
- two industrial extension services launched on the Internet (FICCI's EIC, CTI website)
- a concessional finance system in place and 2 firms in application pipeline
- clean technology partnerships with 8 Indian industry associations and close working relationships with 31 business organizations.
- Strong Indian industry interest in establishment of an Indian GEMI.

In addition, during this time there was a four-fold increase in the number of firms certified under ISO 14001. While CTI itself cannot take credit for these newly certified firms, the change and trend are significant, and CTI's outreach efforts have clearly contributed to the ongoing upsurge in ISO 14000 interest and understanding.

Before and After CTI		
CTO Activity Indicators	1997	1999
• Firms ISO 140001 certified	25	150
• Industrial extension systems in place	nil	2
• Clean technology web sites	nil	2
• GSCM systems in place	nil	1
• Benchmarking	nil	2 sectores 12 Firms
• Concessional	nil	16 Proposals 2 in evaluation
• Sectoral GHG emissions reduction reports	nil	2

Many accomplishments, of course, are significant but difficult to quantify. Most notable is an understanding within the 9 industrial sectors with which CTI engages of the business reasons for improving their environmental performance. The global tools of ISO 14000, GSCM, environmental performance benchmarking, and Internet industrial extension, are being increasingly used and knowledge about them spread by Indian industry. As a result, traditional regulatory controls have now been augmented by private voluntary activities, and in the future government environmental policy can build on the new opportunities presented by market-based incentives in India.

4. CTI Activities

4.1 ISO 14000 Certification

To support the grant from ICICI to the Confederation of Indian Industries (CII) for the design and implementation of ISO 14001 in India, IRG provided technical assistance to selected Indian companies. Sectors selected were: automobiles, textiles, and pulp and paper. CTI selected nine plants, three in each sector, based on criteria established, including compliance, commitment to ISO 14000 certification, and location.ⁱⁱⁱ In addition, CTI provided technical assistance to four units of the Steel Authority of India Ltd. (SAIL). (The specific plants are listed in Appendix B.)

To support the ISO 14000 work CTI supported business exchanges by participating Indian industries to the US, in addition to ISO training.^{iv} The SAIL delegation visited an iron and steel facility in Korea as well as facilities in the US.

4.1.1 ISO 14000 Approach

Our work has focused on two needs: first, to inform enterprises of the benefits of ISO 14001 to their operations, and second, to demonstrate these benefits convincingly to senior managers so that they, in turn, can instill support for the environmental management system throughout the facility and in all ranks of employees. Throughout our work in India we have found that ISO 14001 adoption faced a handicap from some experiences with ISO 9000 as a cosmetic exercise, and the widespread perception that ISO 14000 might be the same. On the other hand, with understanding of the tangible benefits that ISO 14000 could bring, experience with ISO 9000 or QS-9000 programs could be usefully adapted to environmental management.

4.1.2 End of Project Status:

Nine industrial facilities: Of the nine private industry facilities enrolled in the CTI ISO 14000 program, one, a Maruti auto parts facility, dropped out due to a fire at the facility. Continuous progress was made over the past two years by the remaining eight units, albeit at considerably different paces.

Two of the eight plants, Maruti and Pudumjee, felt confident enough to go directly to pre-certification registrar audits. They are expected to achieve certification during the fourth quarter of 1999. For the remaining six, IRG conducted audits in August and September 1999 to assess the companies' own environmental management system requirements and requirements of ISO 14001. Auditors examined documentation and included inquiries of personnel, observations of activities and conditions, and other tests. As a result, IRG's best estimate is that, if CTI ISO 14000 work continues vigorously following completion of the IRG CTI contract on September 30, 1999, all eight of the nine originally selected facilities can be certified in the first quarter of 2000.

The Audit Summary Report by IRG's Rainer Ochsenkuehn for USAID^v prepared for five companies (Alps Industries, Winsome Group, Luthra Dying and Printing mills, Mark Auto, and Century Pulp and Paper) concluded that they were in various stages of EMS implementation but

not as far along in the process as had been expected earlier in the year. Pre-assessments by the registrar can be performed after the EMS implementation is complete and sufficient data have been gathered and made available to prove effective implementation of the ISO 14001 EMS. Normally records need to exist for at least three months prior to registration. Hence pre-assessment audits should be performed for Century Pulp and Paper by the end of September, for Winsome Textiles by mid October, for Alps Industries by the end of October, for Mark Auto by mid November, and by Luthra by the end of December. In each case certification audits should follow some four to six weeks later.

The audit report and summary provided specific findings and recommendations for each of the facilities. Among the key findings:

- For some facilities, top management needs to show more ongoing support for the EMS in order to help the company make the required cultural changes;
- Top management commitment to ISO 14001 EMS adoption, however, is insufficient by itself, as it is essential for it to be accompanied by more vigorous engagement of department heads and employees down the line;
- Experience with ISO 9001 and QS-9000 Quality Management System can provide an efficient framework and basis of experience on which to develop an EMS;
- Continual improvement of the EMS needs to be regularly ensured and proven through records, and new processes, products and services need to be regularly included into the EMS to ensure effective system maintenance; and lastly,
- *Timely certification will be influenced by the leading role of CII and IRG's successor contractor in closely monitoring the progress and in providing assistance to the companies in the coming months.*

4.1.4 End of Project ISO 14000 Status of SAIL

SAIL is India's largest and the world's ninth largest steel producer with a turnover of \$ 3.37 billion. Its five integrated steel plants at Bhilai, Durgapur, Rourkela, Bokaro and Burnpur have a total capacity of producing over 12 million tonnes of crude steel. Three plants at Salem (where a plant is already ISO 14001 certified), Durgapur and Bhadravati are engaged in the production of special and alloy steels and a plant at Chandrapur, Maharashtra is a bulk producer of ferro-alloy. SAIL has a good number of captive iron ore mines. SAIL's vast portfolio of long and flat products have captured a good portion of local market as well as it is being exported to many countries. SAIL management, realizing that ISO 14001 provides an opportunity to link environmental objectives and targets with specific financial outcomes through resource efficiency, decided to seek ISO 14001 in a phased manner. SAIL selected Bhilai and Bokaro Steel Plant and Dalli and Meghtatuburu iron ore mines for design and implementation of Environmental Management Systems based on ISO 14001.

In response to SAIL's request for technical assistance, CTI provided US technical assistance for providing training to plant representative from Rourkela, Bhilai, Dalli and Meghtatuburu. A pre-certification audit has recently been done to assess the readiness of SAIL's units.

With respect to certification of the four SAIL units, our best, most realistic estimate is completion of certification by June/July 2000. Our reasoning is as follows:

When IRG's ISO experts visited the SAIL units (two steel plants and two iron ore mines) in early March 1999, and the mines again in April 1999, most of the units were at a very preliminary stage of ISO 14001 readiness. Three units lacked understanding of impact analysis, procedures, objectives/targets, and they presented significant areas for improving their environmental performance. They had not yet engaged any consultants and had not begun training on ISO 14001 for the more than 1000 employees at each unit. The Bureau of Indian Standards (BIS) has recommended the fourth SAIL unit (at Bhilai) for certification. However, we must note that BIS is not accredited by any international agency to provide ISO 14001 certification, and it launched this certification service only recently. Questions concerning their quality control, including the auditing practices they follow, remain unanswered.

Based on our experience, a best case timeline for certification of unprepared units like those of SAIL is between 10 and 12 months, from start to finish. Thus, our best case timeline would be for certification of all four units by March/April 2000. However, we believe it is reasonable, albeit unfortunate, to add a slippage period of 3 to 4 months for reasons that are beyond CTI's control to reduce. We believe that our revised estimate of June/July 2000 is more realistic since the best case timeline does not: (1) include a three month period of effective EMS operations that some of the well-reputed registration agencies require to certify conformance to ISO 14001; (2) take into account that the USAID contractor under CTI acts as an external consultant and facilitator with staff operating the facility responsible for actual implementation; and (3) acknowledge that the SAIL units are proceeding slowly in many cases due to management and operational issues commonly found in the public sector, such as the absence of incentives from top management for speedy implementation.

4.1.5 Lessons Learned

Overall lessons learned from IRG's ISO 14000 work:

- The selection process for pilot ISO 14000 sites is critical in determining future success, and particularly important are management understanding of the business benefits of adopting the ISO 14001 EMS, as opposed to the cosmetic public relations value, and management financial commitment to ISO 14001.
- Ensuring that companies are in compliance with applicable environmental laws and regulations is a top priority, but throughout the project IRG encountered lack of awareness concerning the applicability of certain environmental laws and regulations. CII, as the expert on Indian regulations, needs to ensure stronger commitment to compliance, for example, through compliance audits, before companies seek certification.
- Smooth coordination with the participating companies, and among the USAID CTI partners – USAID itself, CII, and the contractor—is essential to meet the company training and TA demands and the certification timetable.

4.2 Benchmarking

IRG's benchmarking work for CTI focused on data gathering and analysis work with pilot facilities within the cement and agro-based paper and pulp, particularly the agro-paper and pulp, sectors. The pilot benchmarking work has been completed as planned by the end of the contract. The cement and paper and pulp sectors were also chosen for IRG's detailed study, which was carried out for IRG by the Tata Energy Research Institute (TERI), whose reports were completed in September, 1999. These surveys sought to identify and rank major information gaps and needs based on current trends of GHG emissions, assess levels of awareness of GHG opportunities and needs, identify incentives and opportunities for promoting clean technology and EMS applications.

4.2.1 Survey of Cement and Pulp and Paper Industrial Environment

The TERI survey reports provide useful background data and analysis helpful in putting the IRG benchmarking work in appropriate economic, environmental, and GHG emission reduction contexts. Both sectors are substantial energy users. Energy accounts for 20-25 percent of the total cost of paper and pulp manufacturing (TERI Pulp and Paper p. 1), and cement accounts for 18 percent of total manufacturing sector coal consumption and over 5 percent of manufacturing's electricity consumption (TERI Cement p. 2). The surveys described the sectors, identified energy and environmental improvement options for each sector and analyzed the energy and CO₂ savings possible.

Cement survey: The cement industry survey concluded that despite having been plagued with low production efficiency, energy efficiency improvement has begun in earnest, compelled by business necessity. Energy consumption and energy intensity trends are down, although still below the world average. Despite absence of GHG emission records beyond 1994-5, the survey anticipates declining trends thereafter. The study concluded that over 18 million tons of CO₂ emissions could be avoided annually with implementation of all the listed energy efficiency measures. (TERI cement p. 30.) More specific economic policy instruments – depreciation allowances, import concessions, duty exemptions, pollution charges, regulatory incentives, and so forth – are deemed necessary to help the industry develop cost-effective technologies and generate revenues to support management measures that in turn can reduce GHG emissions through cleaner fuels and improved technologies. The industry survey reported interest in incentives such as soft loans, concessions for fuel and raw material substitutability to ensure sound environmental practices in the cement industry.

Agro-Paper and pulp survey: The entire sector has suffered from decline since 1995 resulting in capacity use of only 76 percent. Scarce raw materials, high capital intensity, erratic and costly electric power, and imbalanced duty structures also harm the industry, and there have been no new paper and pulp mills over the past ten years. Although the industry survey was hampered by the lack of a centralized database, it estimated annual CO₂ emissions at 2.39 tons/ton of paper, down from 4.3 tons of CO₂ in 1981-2. Because plants are on the average over 20 years old and most Indian plants are small compared to those in developed countries, the Indian industry energy efficiency performance compares badly to world or even Asian standards. It found large potential for energy consumption and GHG emissions reduction, and although investment costs are high, the opportunities were deemed promising for outside investment. As with the cement

industry, the paper and pulp industry would welcome financing and economic policy incentives and the development of demonstration projects that could catalyze broader-scale adoption by the industry.

4.2.2 IRG Benchmarking with Cement and Agro-Paper and Pulp Industry

1. IRG designed its benchmarking as a performance analysis system for tracking productivity and energy and resource efficiency at the sectoral, company or facility level based on the national and international performance benchmarks. Our benchmarking activity was conducted in partnership with the Cement Manufacturers Association (CMA) and the Indian Agro Paper Mills Association (IAPMA) and with the engagement of six firms in each sector. (A list of firms is provided in Appendix B.) By project's end, under direction of Mr. Shakeb Afsah, IRG achieved the following results for CTI:
2. We completed the analysis of benchmarking and rating for 12 factories, six each from the cement and agro-pulp and paper sectors. Results show the potential for improvement in energy efficiency and environmental performance and how much improvement can be achieved – including improvement in GHG emission reductions—through investment in technology and by changing management practices.
3. We completed a comprehensive questionnaire for data collection for the cement and agro-pulp and paper sectors. The questionnaire can serve as a model for replicating the benchmarking program in the future in other sectors.
4. We completed an operational computer model for benchmarking that has been established at the cement and agro-paper and pulp associations. It will allow them to pursue their own augmentation of the benchmarking system through the addition of additional facilities.
5. We trained eleven staff from the CMA and IAPMA on the operations of the benchmarking system.
6. We provided USAID a final report on the benchmarking task.

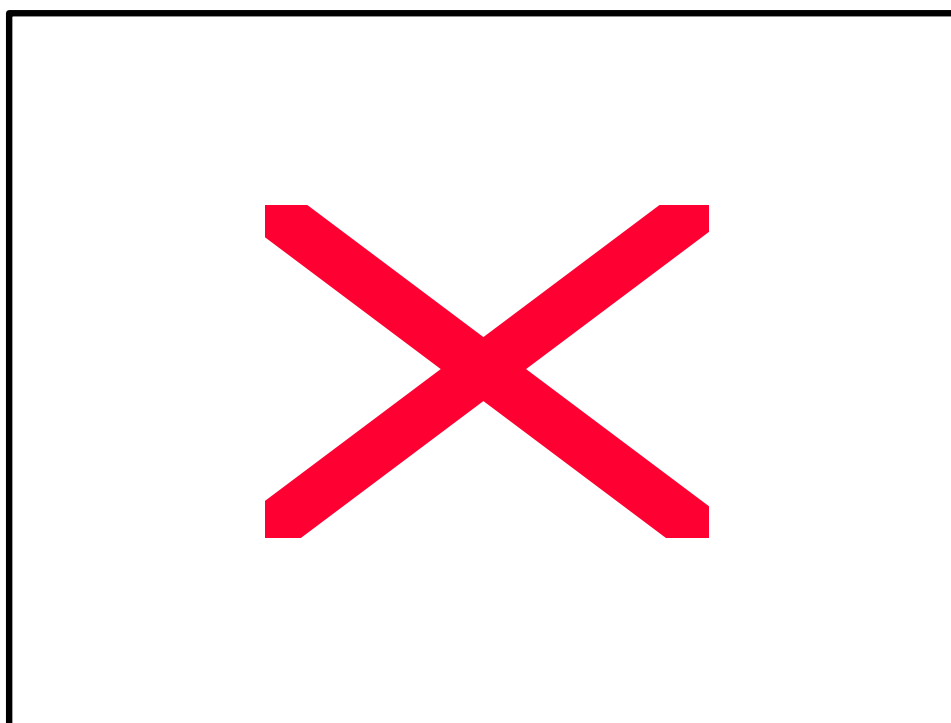
Key features of IRG's benchmarking for the two industries included the capacity to:

- analyze levels and trends for energy, environment and financial indicators
- Provide comparative analysis based on the Indian and international benchmarks
- Dynamic and adjustable to new technologies
- Evaluate least cost strategies for CO₂ reduction
- Include a knowledge base on climate friendly technologies.

The IRG benchmarking activity as completed was designed to result in collection of unit-level data from participating firms and subsequent integration into a decision framework that can

assess GHG emission reduction opportunities. IRG's Mr. Gary Goldstein, an expert on GHG/GCC issues and modeling efforts to respond, came to India under CTI, presented CTI green lectures concerned with GHG emission reduction modeling opportunities. He worked with Indian counterparts on ways apply MARKAL, which IRG identified as the preferred integrating framework. MARKAL is a well-established technology economic model familiar to Indian institutions such as TERI.

The methodology employed by the IRG/CTI benchmarking is explained in the final report on benchmarking.^{vi} It's approach is illustrated by the figure below.



4.2.3 Lessons Learned

Among the lessons learned from our benchmarking work and supporting analyses:

- Companies need to be shown the value of benchmarking for their facilities, including value for application to the EMS, identification of opportunities to reduce costs, improve competitiveness, reduce GHG emissions and other local pollutants.
- There is immense potential in India for improvement in energy efficiency, and therefore GHG reduction, in such sectors as steel and paper, where Indian energy input per unit output in these sectors is from three to four times less efficient than in the US and Japan.

- Industry associations are critical in helping to encourage application of benchmarking, the collection and verification of accurate data, as well as the broad dissemination of information that demonstrates the value of benchmarking.
- Benchmarking results should be perceived as offering not simply technology solutions but also EMS solutions for achieving cost reductions and environmental improvements.
- Application of a customized MARKAL offers a tool to evaluate a wide range of least-cost GHG emission reduction strategies in India nationally or by industry sector, including industrial process improvements, reduction of non CO2 GHG emissions through end-of-pipe and process substitution, materials substitution, and waste recycling and energy recovery, among others.

4.3 Greening the Supply Chain

4.3.1 Project Activities

CTI has made a promising beginning in addressing the opportunities to spread the impact of EMS to reach smaller suppliers. After time-consuming delays caused by contractual and rate approval barriers that were eventually overcome by a direct grant to ATIRA from USAID, IRG worked with ATIRA in organizing and conducting a workshop to initiate GSCM in India. IRG provided on-site assistance to six pilot facilities to design a GSCM program, supported technical assistance in cooperation with the US-AEP for a US exchange to observe GSCM in practice, and supported a GSCM workshop with Maruti.

4.3.2 Lessons learned

- A clean technology project that is limited to large companies in India will fail to have any visible national impact.
- Benefits from the adoption of clean technology by Indian industry require a spreading influence of better EMS (through ISO 14000) well beyond the large firms.
- Vast, still-untapped market forces affecting Indian industry offer significant opportunities for effective GSCM actions under CTI.

4.4 Project Finance

4.4.1 Project Activities

As initially planned CTI's project financing activities were planned to begin in early 1998. The first step was to identify clean technologies in selected industrial sectors and then to demonstrate their application in individual facilities. A fund of approximately \$9 million was available. ICICI

initially took the lead in this activity and IRG delivered (first quarter 1998) a scope of work for technology needs assessments in the pharmaceutical, food processing and metal fabrication finishing. ICICI produced an advertisement in major newspapers to solicit clean technology project financing proposals from Indian private industries in all sectors as defined in its scope of work.

In May 1998, with the halting of the project by USAID following the Indian nuclear testing, all project proposals received were submitted to ICICI. The project financing activity was then redesigned to focus on GHG/GCC issues. Under the new plan, IRG was to solicit proposals for feasibility studies on clean technologies for reducing GHG emissions. A fund of approximately \$500 thousand was to be available. IRG conducted a sectoral review for 12 sectors, based on an ADB report on its energy efficiency program in India, and two sectors were chosen – cement and pulp and paper. IRG reviewed all relevant earlier technology assistance projects under TEST, and the proposals received by ICICI under the initial CTI solicitation. A work plan, budget, and scope of work and the format for the Request for Proposal document were completed by November 1998. In December IRG met with and marketed to Indian industry associations, other partner institutions, and some individual companies to solicit proposals for clean technology/GHG emission reduction feasibility studies.

During the first quarter of 1999 IRG, ICICI, and USAID reviewed six feasibility study proposals. IRG prepared the approved criteria for evaluation, and two project proposals were selected for further evaluation. However, in April USAID informed IRG that proposals should only be received for project financing, skipping the feasibility study step. Approximately \$1.3 million was then, and is now, available.

IRG planned to conduct a series of marketing workshops with US-AEP, UNEP's Cleaner Production Center (CPC) and other partner associations. Staff visited two facilities near Calcutta that had submitted proposals, and met with Indian Agro-Paper and Pulp Association, the Mahratta Chamber of Commerce and Industries, EPTRI Hyderabad, Punjab, Haryana, and Delhi Chamber of Commerce and Industries, the CII, and others. However, IRG was informed in June 1999 that it should not hold the workshops following expressions of Congressional Foreign Relations Committee questions about the USAID India program. By June 30 1999, however, due to marketing in April and May, IRG had received 16 proposals.

In July IRG reviewed these proposals, along with ICICI and USAID. Of these, six were selected for more detailed evaluation. Two of them were finally selected for submission to ICICI, and both were presented to USAID on September 30, 1999.^{vii}

4.4.2 Lessons Learned

Since the project began in 1997 no clean technology project or feasibility studies were financed in the selected CTI sectors. Nevertheless, as a result of IRG's experience in designing, soliciting, and evaluating project financing and project feasibility proposals, a number of important conclusions and lessons can be drawn. Among the most important criteria for the conduct of CTI in the future are the following:

The technology to be financed must lead to savings in energy, water and/or material use and/or reduce toxicity and greenhouse gases.

The proposed technology should be designed to enhance or improve upon a production process (e.g finishing/drying in textiles) and not to overhaul the complete manufacturing process.

Facilities should demonstrate the capacity and commitment to dedicate the resources necessary for comprehensive installation and operation of the technology.

The technology must be recognized and deemed relevant by the industry to ensure replicability across the industry.

Given the short (3 year) duration of the CTI project and the ambitious goal of financing 20 projects, the following guidelines should be considered:

1. Evaluation criteria should be firmly established at the outset to improve the ratio of projects approved to project applications. Project approval rate by ICICI/USAID has been around 5-10 percent, based on the experience in the first phase of CTI (i.e on an average, for every 100 proposals identified only 5 to 10 would be cleared) , and this percentage will need to be considerably increased.
2. The total amount of funds for the activity should be earmarked and maintained at the start of the project in order to generate interest and to establish reliability of the project in the eyes of the private sector.
3. Sector selection and the scale of operation should be fixed based on total amount of funds for financing.
4. A cluster approach should be adopted, allowing a particular group of industries in a region to apply and participate. This will enhance the replicability of demonstration projects.

4.5 Industrial Extension

4.5.1 Project Activities

CTI's "Industrial extension Systems" activity was initially designed for conduct of a study and report on the ways that industries seek and obtain environmental information necessary in business decision making. At the outset of the project it was unclear how and from whom companies in target industrial sectors obtained needed environmental management and technology information and. how adequate the currently available sources were.

During the first nine months of the project, as IRG worked with industry representatives we learned a great deal about the existing information sources in India. Much unstructured and scattered environmental information was available from consultants and technology suppliers. Other important sources, also unstructured, included trade journals, the Internet, technology

suppliers, consultants, universities, industry/trade associations and government agencies. By early 1998 the initially proposed study was designed to provide specific recommendations that could strengthen the delivery of environmental information through existing industrial extension systems, improve access and utilization of existing industrial extension systems, and promote best practices in environmental information collection and use by target industrial sectors. The study finding will be incorporated into the existing web based extension system established as the Environmental Information Center (EIC)" at FICCI.

The study idea itself was abandoned by mid 1998 because study costs were bid at higher costs than staff determined was reasonable, and increasingly the information to be obtained looked to be of problematic value. Moreover, the topic of "industrial extension" was itself a term of art with which business was not widely conversant.. So IRG became doubtful that an elaborate survey was appropriate or necessary to address the highly individual needs and characteristics of individual companies.

IRG staff concluded that we did not need an elaborate survey to take the important step of helping FICCI strengthen its EIC with relevant environmental information. It would include data on environmental technologies and practices, environmental legislative requirements, information on sources of project financing available to industries and information on other policy issues. Subsequently CTI provided technical assistance to EIC to make it more focused and user friendly. IRG helped CTEM provide information on clean technologies and practices directly to EIC to enrich their information contents. The information on legal and other policy issues has also been provided in the EIC.

In order to enrich EIC with information on various project financing options, IRG engaged consultants to carry out a survey of the financial institutions. The survey focuses on various multilateral and bilateral funding agencies including the national bank operating credit lines for financing environmental projects. The survey results will include an analysis of various schemes and provide summary to allow the industries facilitate quick investment decisions.

As a result of this CTI activity FICCI's EIC has become a center of environmental information for industry. World-wide Internet resources have been, and are increasingly, brought to bear on Indian needs via EIC, and IRG's consultant (Bill McSpadden, associated with the Global Environmental Technology Foundation) provided technical assistance to FICCI to enhance the value of its website. (See, <http://www.cleantech India.com>) .

The concept of regional information centers has developed as well. These will provide personalized, hands-on assistance to industries. But again, the Internet will provide a means to ensure that the best information is obtained for these centers.

IRG also established a CTI website (<http://www.cleantech India.com/CTI>) linked to FICCI's site. CTI is a key information resource for publicizing the project concept and its long-term vision for clean technology and ISO 14001 adoption in Indian industries. Containing summaries of all major project activities and text of green lectures and other reports, it serves as a major tool for the CTI outreach activities generally. It can in future serve as the information point for demonstration projects funded through ICICI.

4.5.2 Lessons Learned

CTI's engagement in the industrial extension field should remain highly flexible and responsive to changing needs and priorities of Indian industries. It should certainly avoid spending time and money in providing new industrial extension services absent clear demand. While the Internet should be augmented by other mechanisms, it remains the key to obtaining and disseminating the most up-to-date and comprehensive experiences of other companies, and the services and technology being offered on the market. While India lags behind other industrialized nations in use of the Internet, it is clearly coming, and India needs CTI's help to prepare for its inevitably significant impact.

Our specific recommendations:

1. Strengthen EIC in *“Up-to-date and relevant content, presentation and user-friendliness”*
 - The content could be enhanced by entering into agreement for purchase of environmental data bases with similar information service providers in the US such as GETF, ETNA, USEPA
 - For updates of environmental information, CTI should engage experts of repute in the US and India to provide regular information to EIC
 - The presentation of the EIC web site will need regular updates to keep up the appeal and freshness of the site for regular subscribers
 - The site will need to be constantly reviewed for user friendliness as it becomes new in its content and caters to new user categories
 - EIC should establish Synergy Centers at other industrial towns to provide more personalized service to the industry users especially to those that do not have access to the internet
2. Improve Publicity
 - Engage consultants to publicize the EIC service in country and to users in other countries
 - Initiate a Newsletter sending out “new information on EIC” to all subscribers
 - Have an EIC web-link inserted in web-sites of other similar environmental information service provider.

4.6 Outreach

4.6.1 Project Activities

Environmental Lectures: CTI's outreach programs to support project objectives focused on environmental lectures and green papers. Four eminent environmental lecturers participated from the United States:

- Mr. Joe Cascio, Chairman US Technical Advisory Committee on ISO 14001, spoke on *International trends regarding ISO 14001 implementation*, at Chennai, Mumbai, and Calcutta during December 1998;
- Mr. Mike Toman from Resources for the Future, spoke on *Incentive Based Environment Regulation* at the Clean Tech Environment '99 conference, as well as at the Federation of Andhra Pradesh Chambers of Commerce and Industry in Hyderabad and at CII, Chandigarh during February 1999;
- Mr. Daryl Ditz from the Environmental Law Institute, spoke on *Does Environmental Law Matter?* and also on *Clean Technology and Legal Frameworks in India* at Clean Tech Environment '99 conference and at the Federation of Andhra Pradesh Chambers of Commerce and Industry in Hyderabad during February 1999;
- Mr. Gary Goldstein from IRG spoke on *Energy Planning and the Development of Carbon Mitigation Strategies* at the Indian Institute of Management, Ahmedabad, Tata Energy Research Institute, Delhi and at Indian Institute of Technology, Delhi during February 1999.

4.6.1.2 Green Papers: CTI has produced one Green Paper which addresses issues of interest to the Indian business community and would serve as a general source of information. The Green Paper on *Cost Benefit Analysis of Implementing ISO 14001 in India* has been authored by a well known expert, Mr. K.P. Nyati who heads the Environment Management Division at the Confederation of Indian Industry (CII). This paper analyzes the current trend of ISO 14001 certification across the public and private sectors, and specific industry sectors as well. The paper also throws light on the perception of Indian industry and business about adoption of ISO 14001 and its costs and benefits as compared to ISO 9000. It documents the experiences of the firms that have already undergone ISO 14001 certification and reflects the current ground realities and suggest ways to make ISO 14001 a useful instrument for catalyzing companies to voluntarily and proactively contribute towards reducing their GHG emissions.

4.6.1.3 GEMI: In March 1998 IRG hosted an Indian industry delegation to visit the United States to attend the annual conference of the US Global Environmental Management Initiative on *Business Helping Business – How EHS Adds Value to the Bottom Line*. The main thrust of the conference was on sustainable development to meet the needs of industries in the future without compromising environmental quality. As a result of this trip, and contacts made, the delegation returned to India with strong interest in establishing an institution like GEMI that would develop tools, techniques and procedures that would stand as models for Indian companies to improve

their environmental performance.^{viii} Promising contacts were made with the American Business Council, in Delhi, and the issue was discussed in their Executive Council meeting. Interest also exists within TERI and CII to support such an initiative. IRG in Washington established strong links with GEMI and its individual members, to provide supporting ideas and guidance should Indian industries pursue the establishment of a “GEMI.”

4.6.1.4 Asian Leadership Tours: The purpose of the Asian Leadership Tour was to provide opportunities for representatives of Indian industries to observe operations of state-of-the-art environmental management and technologies elsewhere in Asia. IRG worked with IIE to arrange two such tours, one for the cement industry, and another for the pulp and paper industry in August 1999. Ten participants from the cement sector and eight in paper and pulp, along with an IIE representative, visited Thailand, Taiwan and South Korea. As a result benchmarking information from companies in these countries was collected and incorporated into IRG’s benchmarking system for each sector. In addition, the Indian companies learned about environmental management systems and practices, as well as clean technology applications that proved useful in their own plants.

4.6.2 Lessons Learned: The importance of outreach to CTI’s success has been demonstrated by IRG’s experience. Outreach, of which industrial environmental extension is an important component, requires application of a range of activities focused on reaching both broad public as well as industry specific audiences. Specific lessons learned from IRG’s implementation of CTI’s outreach activities include:

- *Green papers:* It was difficult to engage well known authorities for green papers in India given the USAID ceiling of \$103 per day. More flexibility to remunerate at a higher rate will be required in the future . In addition, topics as well as authors need to be carefully identified according to agreed criteria in order to ensure maximum impact and interest.
- *Promotional materials:* Clear guidance on criteria for design, the approval process, and distribution should be established for the next phase of CTI.
- *Project promotion strategy:* The entire CTI outreach activity should be established on the basis of an overall strategy to include media coverage, writing of articles, preparation of newsletters, participation in conferences and integration of business exchanges with outreach events.

5. Conclusion

The CTI project is unique within the array of projects funded under the Global Bureau's EPIQ. The experience gained over the past two years in India strongly supports its emulation elsewhere as a project focused on voluntary enhancement of industrial environmental performance that can complement regulatory approaches. Where regulation and enforcement are weak, as in India, CTI's emphasis on "the business case" for applying clean technology and environmental management systems in India has been shown to be highly effective.

Yet CTI's efforts are miniscule in comparison with the size of India's industrial sector and the environmental and GHG emission reduction requirements. CTI has provided tools and experiences, but its success will depend on a vigorous outreach program to demonstrate successes and spread their effect. Even so, much will depend on the strength of globalization in India and the positive impact of buyer and consumer concerns about industrial environmental performance. Indian policy makers can be expected to take new interest in market-based policy tools to complement and reshape their regulatory approaches and perhaps to reevaluate economic policies that still discourage market forces to work for environmental improvement.^{ix} IRG's experience over the past two years, and best estimates of the future, suggest that the global pressures favoring market-based policies within the private sector and the public sector will increase and that CTI, upon its completion, will leave a legacy for which USAID/India can be immensely proud.

End Notes

ⁱ CTI produced two reports on environmental reporting: *Environmental Performance Reporting and Disclosure by Indian Businesses; Assessment report to USAID's Clean Technology Initiative Project*, by Malcolm F. Baldwin, IRG, February 23, 1998 (New Delhi), and *Keynote Address, Environmental Reporting and Disclosure*, by Malcolm F. Baldwin, IRG, for the CTI Environmental Reporting Workshop, *Workshop*, New Delhi, April 6, 1998.

ⁱⁱ Baldwin, Malcolm, *India, US-AEP Country Assessments*, Washington, D.C. 1996.

ⁱⁱⁱ Selection Criteria for Demonstration Units, CII-USAID-ICICI Project on Promotion of Environmental Management Systems, (as Per ISO 14001) in Indian Industry, ISO 14001, CII Project File #3.

^{iv} Organizations visited in the United States (5 May- 14 May 1999) included: the Institute of International Education, American Iron and Steel Institute, US Department of Energy- Office of Industrial Technologies, US Environmental Protection Agency- Climate Wise Program, Wheeling Pittsburgh Steel Corporation, US Steel Group- Clairton Works, Amerikohl Coal Strip Mines, Bethlehem Steel Corporation, Voest-Alpine Industries. A Sail delegation also visited the Pohang Iron and Steel Co. Ltd, in Korea.

^v Ocschenkuhn, Rainer, "EMS ISO 14001 Audit Summary Report, September, 1999.

^{vi} Afsah, Shakeb, "Final Report on CTI Benchmarking for CMA and the IAPMA," October, 1999.

^{vii} Project Financing Proposal, "Application of Oxygen Delignification in Non-wood Pulp and Paper Mills," Madhya Bharat Paper Mill, September, 1999; and Project Financing Proposal, "Co-generation (5MW) for a 60 TPD Kraft Paper Mill," Khatema Paper Mill, September, 1999.

^{viii} *See*, The GEMI Report, prepared by IRG for CTI, May 1998.

^{ix} The topic received attention early in 1997. *See* "Report of the Task Force to Evaluate Market-Based Instruments for Industrial Pollution Abatement," submitted to the Ministry of Environment and Forests, Government of India, January 1997.

Appendix A

IRG/CTI – Events Matrix

EVENT TYPE	DATES	THEME	ASSO./PERSONS
workshops			
1. ISO 14001 pilot plant identification - paper units	Dec. 1997	Awareness and identification of pilot demonstration projects for ISO 14001 implementation	CII/paper companies
2. ISO 14001 pilot plant identification - textile	Dec 1997	Awareness and identification of pilot demonstration projects for ISO 14001 implementation	CII/ textile companies
3. ISO 14001 pilot plant identification - Automobile	Dec 1997	Awareness and identification of pilot demonstration projects for ISO 14001 implementation	CII/Automobile/automobile components
4. IBA - Bank of America	Oct 1997	Financial Due diligence and environmental risk assessment in project financing	Bankers/ Govt. representatives
5. Indonesia Cleaner production programme (ICIP)	Jan. 1998	Share experience of the Indonesia Cleaner production programme (ICIP)	Various senior persons from different institutions and organisations
6. ISO 14001 at Solan	July. 1998	ISO 14001	35 industry representatives from the region
7. ISO training	Sept. 1998	ISO 14001 training	BIS staff.
8. ISO 14001 and its relevance to Indian Industry	Sept. 1998	ISO 14001	IIT Delhi alumni/ NTPC/30 industry representatives
9. ISO 14001 at Kota	Nov. 1998	ISO 14001	35 industry representatives from the region and Rajasthan State Pollution Control Board
10. ISO 14001 at Baroda	Feb 1999	ISO 14001	25-30 industry representatives
11. ISO 14001 at ICC Calcutta	May 1999	ISO 14001	100 industry representatives
CONFERENCES			
1. GEMI, Washington, D.C.	Mar. 1998	Business and Environment, cost reduction through EMS	CTI delegation/ global businesses
2. CleanTech Environment'99	Feb. 1999	Multi disciplinary theme on environment and business	CII/ various industry and govt. representatives
3. Dakar, Senegal	May 1999	Climate Change and benchmarking	International conference/ CTI delegates from Cement industry

EVENT TYPE	DATES	THEME	ASSO./PERSONS
LECTURES			
1. Steve Dunn	May 1998	Supply Chain Management - Ranbaxy laboratories, Arvind Mills, Hindustan Levers and Bajaj Automobiles	Industry representatives and CTI team

2. Joe Cascio	Dec 1999	Global perspectives for ISO 14001 and its relevance for industry for developing countries like India	Industry and govt. representatives
3. Daryl Ditz	Feb 1999	Does Environmental Law Matter - CleanTech '99, FAPCCI Hyderabad	Industry representatives
4. Mike Toman	Feb 1999	Incentive based environment Regulation - CleanTech '99 and CII Chandigarh	Industry representatives
5. Gary Goldstein	Feb 1999	MARKAL Model - TERI, IIT Delhi and IIM Ahmedabad	Academia and Industry representatives
GREEN PAPER			
1. K P Nyati	Apr 1999	Cost Benefit Analyses of implementing ISO 14001 in India	For broad distribution
exchanges			
1. EIC	Mar 1998		FICCI/USAID representatives
2. HACCP	May 1998	To study the environmental safety and health aspects in the food sector	BIS representatives
3. Project financing	Apr 1999	International financing of environmental projects	USAEP/ IRG
3. ISO	Apr 1999	To study implementation of ISO 14001 and clean technology in US facilities	ISO pilot units/ USAID/CII/ IRG/ other consultants
5a. Asian Leadership Tour (Cement)	Aug 1999	To study benchmarking of environmental performance and clean technologies facilities in South East Asian countries	Cement industry and association representatives
5b. Asian Leadership Tour (Paper)	Sept 1999	To study benchmarking of environmental performance and clean technologies facilities in South East Asian countries	Paper industry and association representatives
6. SAIL - ISO	May 1999	To study the implementation of ISO 14001 in facilities in Korea and the US	SAIL representatives
7. TERI	Apr 1999	To assess the applicability of the MARKAL model in Indian conditions	TERI representatives
8. ATIRA	July 1999	To observe GSCM in implementation in companies in the US	ATIRA, ICICI and CTEM representatives

Appendix B

CTI Working Partners

Organisations:

1. CII	–	Confederation of Indian Industries
2. TERI	–	Tata Energy Research Institute
3. IAPMA	–	Indian Agro Paper Mills Association
4. ICICI	–	Industrial Credit Investment Corporation of India
5. ATIRA	–	Ahmedabad Textile Industry's Research Association
6. ICC	–	Indian Chamber of Commerce
7. FAPCCI	–	Federation of Andhra Pradesh Chambers of Commerce and Industry
8. PHD Chambers of Commerce		
9. AMCHAM	–	American Chamber of Commerce
10. IIT Delhi	–	Indian Institute of Technology
11. BIS	–	Bureau of Indian Standards
12. CMA	–	Cement Manufacturer's Association
13. ERM	–	Environment Resource management
14. USAEP/CTEM	–	USAEP Clean Technology Environment management
15. USAEP/IE	–	USAEP/Institute of International Education
16. IIE	–	Institute of International Education
17. GNET	–	Globe Net
18. GEMI	–	Global Environment Management Initiative
19. GETF	–	Global Environment Technology Foundation
20. RFF	–	Resources For the Future
21. ELI	–	Environment Law Institute
22. CSE	–	Centre for Science and Environment
23. CERC	–	Consumer Education & Research Centre
24. FICCI	–	Federation of Indian Chamber of Commerce and Industry
25. SAIL	–	Steel Authority of India Limited
26. NTPC	–	National Thermal Power Corporation
27. ASSOCHAM	–	Associated Chambers of Commerce and Industry of India
28. ATMA	–	Ahmedabad Textile Mills Association
29. NCPC	–	National Cleaner Production Centre
30. IESC	–	International Executive Services Corps
AIAM	–	Association of Indian Automobile Manufacturers

Companies:

1. **GSCM:** 6 units in the textile sector

2. **ISO:**

Auto Unit:

-
- a) Maruti Udyog Limited
 - b) Mark Auto Industries Limited
 - c) Munjal Swowa

Textile Units:

- a) Winsome Textile
- b) Alps Industries Limited
- c) Luthra Dyeing and Printing Mills

Pulp and Paper Mills:

- a) Century Pulp and Paper
- b) Pudumjee Pulp and Paper Mills Ltd.
- c) Bindlas Duplex Ltd.

Steel Units:

Steel Authority of India Ltd. (SAIL),

- a) Rourkela Steel Plant
- b) Bhilai Steel Plant
- c) Dalli Iron ore mines
- d) Meghahatuburu Iron ore mines

Benchmarking

Cement Companies:

- a) Chittor Cement
- b) Shree Digvijay Cement
- c) Maihar Cement
- d) Shree Cement Ltd
- e) The ACC Ltd.
- f) Raymond Cement

Pulp and Paper Companies:

- a) Delta Paper Mills
- b) Kanoi Paper & Industries Ltd.
- c) Madhya Bharat Papers Ltd
- d) The Simplex Mills Co. Ltd
- e) Varinder Agro Chemicals Ltd.
- f) Sikka Paper (Pvt.) Ltd.,

9 pilot facilities in 3 sectors + 3 units of SAIL

Benchmarking: 6 units each from the pulp and paper and cement sectors

Survey of financial institutions: 16 multi and bi lateral organisations

Consultants:

Indian:

-
- | | | |
|--------------------|---|---------------|
| 1. ERM | – | man team |
| 2. ATIRA | – | 2 man team |
| 3. CII | – | team |
| 4. Damandeep Singh | | |
| 5. Mandate | – | 2 person team |
| 6. MK Raju | – | 7 person team |
| 7. CMA | – | 7 person team |
| 8. IAPMA | – | 5 person team |
| 9. TERI | – | 6 person team |

US:

1. John Wolfe
2. Raymond Patchak
3. Avijit Dasgupta
4. Rainer Oschenkuhen
5. Joe Cascio
6. Mike Toman
7. Daryl Ditz
8. Steve Dunn
9. Gary Goldstein
10. Bill McSpadden
11. Shakeb Afsah
12. Malcolm Baldwin
13. Philip Marcus
14. Trias Harmanu

Appendix C

CTI's ISO 14001 Units

Auto Units:

- Maruti Udyog Limited, Gurgaon in Haryana, is the largest automobile manufacturing company in India. It is a joint venture with Suzuki Motor Corporation of Japan and has an aggregate installed capacity of 250,000 vehicles per annum.
- Mark Auto Industries Limited Gurgaon in Haryana is a medium scale auto component manufacturing unit in joint venture with Maruti Udyog Limited.
- Munjal Showa Auto Limited, Gurgaon in Haryana, is a medium scale shock absorber (an auto component) manufacturing unit in joint venture with Showa Corporation of Japan.

Textile Units:

- Winsome Textile, Baddi, District Solan in Himachal Pradesh, is a large scale dyeing, yarn manufacturing and weaving unit with an installed capacity of 50,000 spindles.
- Alps Industries Limited, Ghaziabad in Uttar Pradesh is a medium scale vegetable dyes manufacturing, spinning and weaving unit.
- Luthra Dyeing and Printing Mills, Surat in Gujarat, is a small-scale art silk fabric dyeing and printing unit having an installed capacity of 7,500 meters per day.

Pulp and Paper Mills:

- Century Pulp and Paper, Lalkuan, Haldwani in Uttar Pradesh is a large-scale wood, bamboo and agro-residue based pulp and paper unit having an installed capacity of 40,000 tons per annum. It manufactures a variety of papers including Azure Wove, Azure laid, Cream wove, M.G.Sulphite Wrapping and offset paper.
- Pudumjee Pulp and Paper Mills Ltd., Pune in Maharashtra is a medium scale agro-residue based pulp and paper mill having an installed capacity of 13500 tons per annum. It manufactures a variety of papers which includes absorbent paper, acid free paper, air mail paper, barrier paper, base paper, bond paper, butter paper, computer print out paper, glassine paper, glazed paper, greaseproof paper, imitation greaseproof paper, intaglio paper, interleaving paper, micro paper, onionskin paper, release paper, security paper, super-calendered paper, tissue paper, tracing paper, twist wrap paper and newsprint.

- Bindlas Duplex Ltd., Muzzafarnagar in Uttar Pradesh is a small-scale agro-residue based pulp and paper unit, having an installed capacity of 9,000 tons per annum manufactures' kraft paper.

Steel units:

CTI provided technical assistance to four units of SAIL, namely Silicon Steel Mill of Rourkela Steel Plant, (Plate Mill), Dalli Mechanised Mines of Bhilai Steel Plant and Meghahatuburu Iron Ore Mines. The assistance was designed to implement environmental management systems and prepare them for certification under the ISO 14001 environmental management systems specification standard.

Appendix D

Benchmarking Participants

Cement Companies:

- **Chittor Cement, Madhav Nagar** in Rajasthan, is a Birla group unit having an installed capacity of 800,000 tons per annum.
- **Shree Digvijay Cement, Digvijaygram** in Gujarat, have three units having a total installed capacity of 1.2 million tons per annum.
- **Maihar Cement, Sarlanagar** in Madhya Pradesh, is a Birla group unit having an installed capacity of 2 million tons per annum.
- **Shree Cement Ltd., Bangurnagar** in Rajasthan, is a Bangur group unit having an aggregate installed capacity of 2.0 million tons per annum.
- **The ACC Ltd., Kymore** in Madhya Pradesh, having capacity of 1.2 million tons per annum is one of the units of the company.
- **Raymond Cement, Gopalnagar** in Madhya Pradesh is a J.K. group unit and has an installed capacity of 2.24 million tons.

Pulp and Paper Companies:

- **Delta Paper Mills, Vendra** in Andhra Pradesh is an agro-residue mill, having an installed capacity of 18,000 tons per annum manufactures azure wove paper, azure laid paper, cartridge paper, cream wove paper, duplicating paper, offset paper, offset printing paper and pulp board.
- **Kanoi Paper & Industries Ltd., Dhenka** in Madhya Pradesh is an agro-residue and waste paper based unit and has an installed capacity of 15,500 tons per annum. It manufactures azure wove, azure laid, bond paper, book paper uncoated, brown wrapping paper, cream wove, duplicating paper, filter paper, kraft paper, Kraft wrapping, notebook paper and poster paper.
- **Madhya Bharat Papers Ltd., Birgahni** in Madhya Pradesh is an agro-residue and waste paper based unit with an installed capacity of 16,500 tons per annum. It manufactures azure wove and azure laid, cream wove, duplicating paper, kraft wrapping, ledger paper and offset printing paper.
- **The Simplex Mills Co. Ltd., Chhenger** in Gondia, Maharashtra, is an agro-residue and waste paper based unit with an installed capacity of 9,000 tons per annum. It manufactures

azure wove, azure laid, bond, crepe, duplicating, glazed, lottery, notebook, photocopying, postcard board, poster and tissue paper.

- **Varinder Agro Chemicals Ltd. (Paper Division), Barnala** in Punjab, is an agro-residue and waste paper based unit with an installed capacity of 23,600 tons per annum. It manufactures ashless filter paper, bamboo paper, barrier paper, battery paper, billing machine paper, black album paper, black line paper, black wrapping paper, bleach kraft paper, book cover paper, book paper uncoated, brush enamel paper, candy cup paper and coated paper/board.
- **Sikka Paper (Pvt.) Ltd., Sikka** in Uttar Pradesh is an agro-residue and waste paper based paper mill having an installed capacity of 6,000 tons per annum and manufactures Kraft paper.